Trans. Inst. Indian Geographers
Vol. 31, No. 1, 2009

Recent rainfall trends in the FCT, Abuja

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Abstract

Certain anomalies within the surface hydrology of the study area prompted the authors to take a critical look of the trend and pattern of rainfall in the past two decades. The derived characteristics of rainfall are obtained and analyzed in order to see salient features of rainfall that are not made visible through copious amount. The specific methods are; Precipitation Periodicity Index (PPI), Onset, Cessation and Length of Rainy Season and Rainfall Intensity. The result obtained showed that the rainfall in the FCT has been declining within the past two decades. This is observed through the monthly, annual average and departure from the mean rainfall. The result also reveal the unique characteristic of rainfall increasing from the south to north in the FCT rather than decreasing in that direction as dictated by the general climatology of the country.

Introduction

Limits to the productive capacity of land resources are set by climate, soil and landform conditions, and by the use and management applied to the land. Sustainable management of land resources requires sound policies and planning based on knowledge of these resources, the demands of the use to which the resources are put, and the interactions between land and land use. Above all, the knowledge of the influence of rainfall characteristics on the above-mentioned resources is very vital. Unpredictable variations in the characteristics of rainfall may result into constraints that could lead to unsustainable utilization of especially the land resources for agricultural production. Some of these constraints are:

i. Impacts of climate variability and change on the agricultural sector are projected to steadily manifest directly from changes in land and water regimes, the likely primary conduits of change. Changes in the frequency and intensity of droughts, flooding, and storm damage are expected. Climate change is expected to result in long-term water resource shortages, worsening soil conditions, drought and desertification, disease and pest outbreaks on crops and livestock, sea-level rise, and so on. Vulnerable areas are expected to experience losses in agricultural productivity, primarily due to reductions in crop yields (Rosenzweig *et.al* 2002, Pradeep and Shane 2003).

ii. Rainfall variability, diminishing arable lands and decrease in agricultural output resulting into food crisis. The economic consequences of reduced rainfall in form of drought are of great concern, especially in area of food supply, because the effect of drought last longer than the effect of excessive rainfall.

iii. In Nigeria, the variation in rainfall pattern from the coast to the north is a reflection of the seasonal variations of the surface location of the ITD. However, the reverse is the case with FCT, where rainfall, rather than decreasing from the south to north, increases instead. This because influenced by the windward side of Jos Plateau (Ologe, *et al.,* 1976, Mabogunje, 1977, Adakayi, 2000, and Hassan and Adakayi, 2003) and probably due to the numerous dams in the north-eastern sector (Hassan, 2008). Thus rainfall decreases both in duration, intensity and amount from the coast to the interior, except where altitudinal effect create island of high rainfall as experienced in the Jos Plateau. But very important and of great concern is the declining precipitation effectiveness (in terms of agricultural productivity) due to anomalous rainfall pattern since the Sahelian drought of 1972-1973 (Adefolalu, 1986).

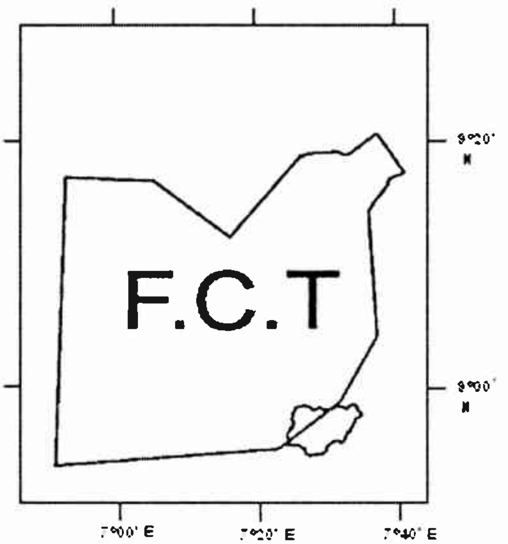

Fig 1: Map of Nigeria showing the study area

The factors responsible for rainfall variation from year to year in the FCT are not far fetched. According to Ologe, *et al.,* (1976), Mabogunje (1977) and Adakayi (2000), the FCT exhibits a transition characteristic between the savannah belt to the north and the rainforest belt to the south. The beginning of the rains (onset dates) is from 20th of March in the southern boundary of the territory to 10th April in the northern limit. The end of the rainy season (cessation dates) ranges from 20th October in the north to about 18th November in the South, giving the durational range of raining season (length of raining season-LRS) to be 190-240 days.

The knowledge of weather phenomena has brought man out of total ignorance of the intricacies of climate and how it controls the complex environmental conditions, be it in the atmosphere, biosphere, lithosphere or the hydrosphere with continual exchange of energy and matter. This results in both short and long term changes currently termed climate variability and climate change respectively.

Sources and Types of Data

The data on rainfall was collected from various institutions such as meteorological institute – Oshodi, Lagos; Nnamdi Azikwe international Airport, Abuja; and the University of Abuja meteorological station for the period 1984 – 2005 (21 years), Other weather stations from which rainfall records were obtained are Abaji, Bwari, Gwagwalada, Karshi, Kwali, Kuje, Municipal, Rubochi, and Yaba.

Computational Technique

Precipitation Periodicity Index

The index is based on the lowest monthly, the highest monthly and the total annual rainfall. It is expressed as percentage. This index is computed using:

$PP = (A/Y - B/Y)\ 100\%$.

Where

PP= precipitation periodicity

A = the highest monthly rainfall

B = the lowest monthly rainfall, and

Y = the total annual rainfall.

This index is used to determine the magnitude of zonal rainfall variability (Hassan, 1996; Hassan and Adefolalu, 2003 and Hassan, 2008).

The Onset, Cessation and Length of Rainy Season

Graphical method was used to determine the Onset and Cessation dates. The LRS is then obtained by subtracting the onset date from the cessation date. LRS = C–O. Besides these Annual rainfall intensity is obtained by dividing the total amount of rainfall recorded in a year by the Length of Raining Season.

Results and Discusions

The downward trend of the precipitation presented by the annual average graph in fig. 2a, began in 1992 it's lowest in 2005. Using the study period average rainfall of 154.1mm was obtained. This analysis of departure of rainfall from mean suggests that the region is tending towards drier conditions. This does not paint a good picture for arable farmers and plant development.

Based on fig 2a, a cycle of below average rainfall can be observed (1988, 1997 and starting from 2002 to 2005). This is the evidence of the decadal hydrologic cycle in Nigeria but with a disturbing trend particularly from 2002 to 2006.

The monthly characteristics of the rainfall in the fig. 2b showed a very disturbing trend within the years from 1986 to 2005, rising only on the average between 1986 and 1994, with 1994 having the highest amount throughout the study period. From 1994 to 2005 there was a steady decrease in the amount of rainfall culminating in the lowest record in 2005 (below 200mm).

Rainfall characteristics as depicted in the fig 3 show Bwari (north east sector of the FCT) standing out with the highest amount of rainfall resulting from the windward side of the Jos Plateau (Mabogunje 1977, Adakayi, 2000).

Bwari has its peak in August followed by the next highest, Municipal, having its peak in July and August while the area with the

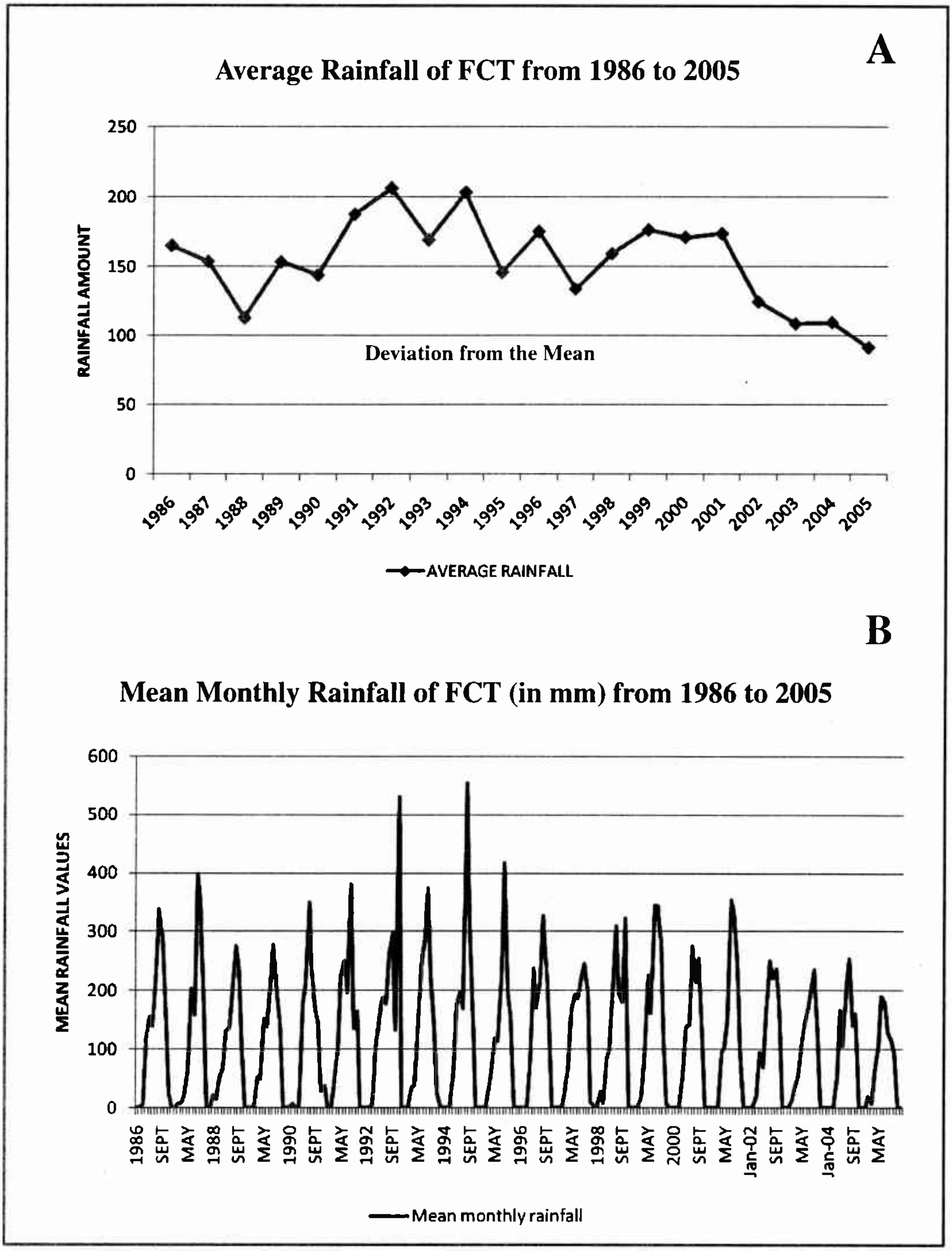

Fig 2: Annual Average Rainfall of FCT from 1986 to 2005 (in mm)

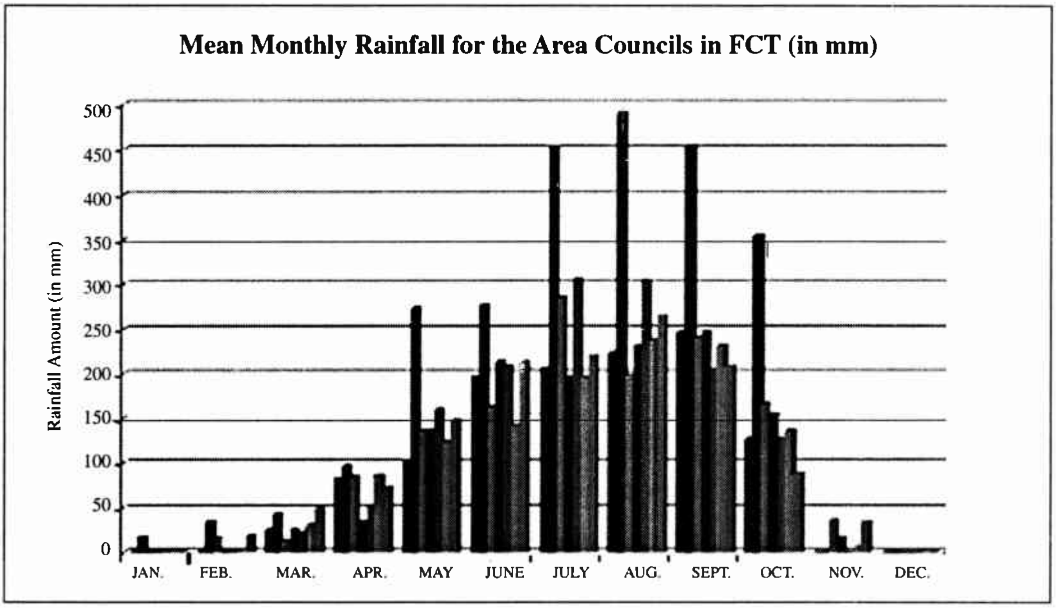

Fig 3: Mean Monthly Rainfall of FCT from 1986 to 2005 (in mm)

lowest amount of rainfall is Rubochi in the south east of the Territory. To get a clearer picture of the nature of rainfall within the territory, a graph of mean monthly rainfall of different station was plotted.

The figure 3 shows the unique characteristics of rainfall increasing from the south to the north rather than decrease in that direction as dictated by the climate of the country. The reason for this is the influence of Jos plateau on the north east border of the territory. This is why Bwari which is at the extreme end of that border appear to enjoy this influence more than the other areas. We therefore followed this up with the zonal monthly rainfall to portray the actual rainfall characteristic in these zones. Mabogunje (1977), Adakayi (2000) pointed out this unusual situation resulting from its location to the windward side of the Jos Plateau.

LRS at different station

Abaji has onset date of the rain on March and cessation (C) date in October. It therefore has eight months of raining season as its Length of Rainy Season (LRS). The peak of rains is in September. Bwari on the other hand has its date to be January and the C date to be November with an LRS of eleven months. Its peak month of rainfall is in August.

Gwagwalada has its onset from February and C by November and an LRS of ten months but varies from year to year, not a permanent feature like that of Bwari. It has double peak with apparent little dry

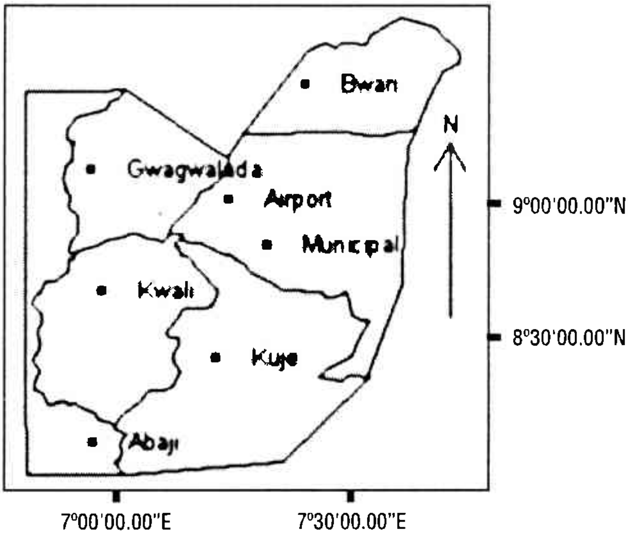

Fig.4: Map of Federal Capital Territory Showing Rainfall Stations

season in August termed August break in many parts of the country. Kwali's unlike Gwagwalada begins in March and the C in November with an LRS of nine months. Its double peak is not well defined and slight little dry season is in July.

Municipal has its onset in March and C in October with an LRS of eight months. Its peak varies between July and August.

Rubochi has its onset around March and C in November with an LRS of nine months. The peak of the rainy season is in August.

Yaba has its around February and C in November with an LRS of ten months. Its peak of rainy season is in August.

This model of PPI was used to unmask the salient feature of rainfall over FCT (fig. 4). This model was first applied on Kaduna State (Hassan and Adefolau, 2003) whose less than 20% periodicity in the south-eastern Kaduna bordered FCT where it is also observed to have similar characteristic of rainfall (fig. 5).

The characteristic patern of rainfall has divided the study area into two climatic zones; the zone of less variable precipitation (precipitation periodicity less than 20%), are the south, south west and the north east of FCT, and the zone of highly variable precipitation (precipitation periodicity greater than 30% are the east through central and terminating at the north of the fig. 4). The zone of less variable rainfall received almost uniform rainfall during the raininig period while the zone of highly variable precipitation has more dry spell period during the active raining months.

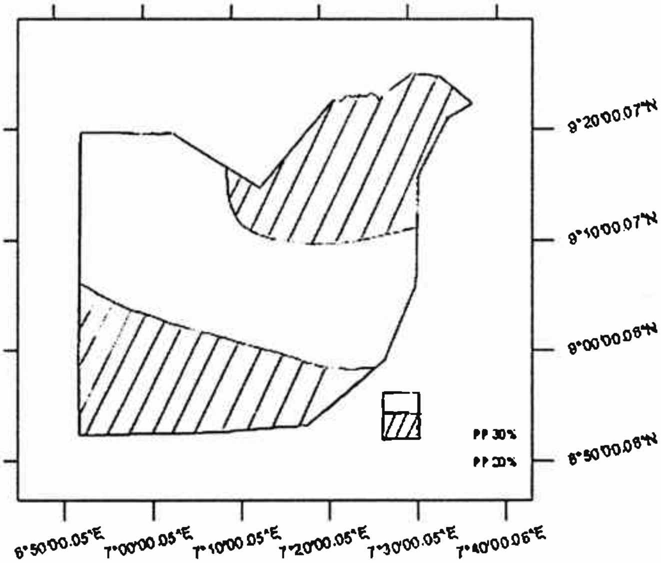

Fig. 5: Mean Annual Rainfall Intensity of FCT (in mm)

Summary and Conclusion

The results from the analyses revealed a declining precipitation trend in the study area that is quite alarming to the eye of any interested agricultural practitioner. The temporary respite is drawn from these scholars (Adefolalu, 1986, 1993, Adebayo, 1996, Adakayi, 2000 and Hassan and Adakayi, 2003) that copious amount cannot be admitted as culprit in agricultural failure. We therefore carried out several other analyses of rainfall characteristics which revealed detailed glooming picture of moisture deficit especially within the central area of the study region. This central area required irrigation of the farm lands during the active periods of the rains if crop yield is to be sustained.

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